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TITLE: LCD OPTICAL WAVEGUIDE DEVICE

BACKGROUND OF THE INVENTION

(a) Field of the Invention

The present invention is related to an improved structure of a LCD optical wave-guide device, and more particularly to a backlight module free of dark band and bright band.

(b) Description of the Prior Art:

As illustrated in Fig. 1 of the accompanying drawings for a sectional view of the structure of a backlight module for an LCD of the prior art, the backlight module is essentially comprised of a reflector mask 10, multiple light sources 20,a diffuser plate 30, a lower diffuser sheet 40, a prism 50, a reflective polarizing sheet or an upper diffuser 60 and a protector sheet 70 arranged in sequence from inside out. Wherein, those light sources 20 may be each a light tube in a stripe, U-shape or other continuously curve and arranged at a proper spacing between the reflector mask 10 and the diffuser plate 30 and the lights emitted by each of those light sources 20 provide the display effects by the LCD. Therefore, the diffuser plate 30 functions to diffuse the lights passing through it to correct the dark band and the bright band created on the LCD due to the absence of light produced at each spacing between two abutted sources 20.

Whereas the diffuser plate 30 functions only to help achieve the even diffusion for lights passing through it, it has a limited efficiency in correcting the phenomenon of the bright band and the dark band observed on the LCD. An improvement is made for certain backlight modules by having extended on purpose the

distance between those light source 20 and the diffuser plate 30 in the hope of widening the scope of each of those light sources 20 entering into the diffuser plate 30 to achieve the purpose of reducing the dark band. However, the structural design for such an improvement not only provides limited effects but also results in that the backlight module must be made thicker to fail the compact requirements of the LCD.

Furthermore, some other backlight modules seeks to provide extinction (dispersion) on the surface of the diffuser plate by printing on the diffuser plate with ink containing SiO_2 or TiO_2 to achieve the purpose of reducing the dark band. Again, the extinction process not only increases the production cost of the diffuser and the complexity of the manufacturing process, but also relates to a passive solution to reduce the dark band on LCD since the extinction is created only after the light lands on the surface of the diffuser.

SUMMARY OF THE INVENTION

The primary purpose of the present invention is to provide an improved structure of an optical wave-guide device to effectively solve the problem of the bright band and dark band on the LCD of the LCD and reduce the spacing between light sources and a lower diffuser sheet to make the backlight module thinner for meeting compact requirements of the LCD by replacing the diffuser plate with an optical wave-guide device. To achieve the purpose, the optical wave-guide device is provided between light sources and a lower diffuser sheet for the lights passing through the optical wave-guide device to be properly refracted and reflected to evenly diffuse via the lower diffuser sheet in providing an active solution.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a sectional view of the structure of a backlight module of the prior art.

Fig. 2 is a sectional view of a backlight module of a first preferred embodiment of the present invention.

Fig. 3 is a sectional view showing that the surface of the optical wave-guide device of the present invention is embossed on the surface facing a lower diffuser sheet.

Fig. 4 is a sectional view showing that the surface of the optical wave-guide device of the present invention is embossed on the surface facing multiple light sources.

Fig. 5 is a sectional view a sectional view showing that the surface of the optical wave-guide device of the present invention is embossed on the surface facing away the lower diffuser sheet.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Fig. 2, a first preferred embodiment of the present invention is essentially comprised of the backlight module is essentially comprised of a reflector mask 10, multiple light sources 20, a diffuser plate 30, a lower diffuser sheet 40, a prism 50, a reflective polarizing sheet or an upper diffuser 60 and a protector sheet 70 arranged in sequence from inside out. Wherein, those light sources 20 may be each a light tube in a stripe, U-shape or other continuously curve and arranged at a proper spacing between the reflector mask 10 and the lower diffuser sheet and the lights emitted by each of those light sources 20 provide the display effects by the LCD.

At least one optical wave-guide device 80 is separately provided between those light sources 20 and the lower diffuser

sheet 50. The optical wave-guide device 80 is made into a plate and provided with multiple recesses 81 each to accommodate respective light source 20, and the light emitted from each light source 20 passing through the optical wave-guide device 80 is refracted and reflected to be evenly diffused via the lower diffuser sheet to provide an active means to eliminate the bright band and dark band otherwise will be formed between any two abutted light sources 20. Furthermore, replacing the diffuser plate of the prior art with the optical wave-guide device 80 reduces the spacing between the light source 20 and the lower diffuser sheet to further reduce the thickness of the backlight module in meeting compact requirements.

The optical wave-guide device 80 may be made of plastic materials including but not limited to Polycarbonate (PC), or Polymethyl methacrylate (PMMA), or Polyethylene Terephthalate (PET) in to a white or transparent stick structure, or made of transparent plastic materials, e.g. PC or PMMA added with diffusion agent (such as SiO2 or TiO2) in a white mat stick structure so to produce the optical wave-guide device 80 with various refraction effects for the selection of the proper optical wave-guide device 80 depending on the spacing between the backlight module and the light source 20.

Now referring to Fig. 3, at least one surface of the optical wave-guide device 80, is locally or entirely distributed with embossment 82 on the surface facing the lower diffuser sheet 40 in a second preferred embodiment of the present invention; or on the surface of the recess 81 at where the optical wave-guide device 80 is facing the light source 20 as illustrated in Fig. 4; or on the surface of the optical wave-guide device 80 at where facing away from the lower diffuser sheet 40 as illustrated

in Fig. 5. The embossment made at least one straight line or curve or the combination of both in a form of V-, U-, or C-shaped cut for the convex of the embossment 82 to create converging effect so to evenly distribute the lights from the light source 20 to diffuse from the concave of each embossment 82, thus to effectively solve the problem of bright band and dark band observed with the LCD of the prior art. Alternatively, the same effects can be achieved by having at least one surface of the optical wave-guide device 80 locally or entirely matted, or printed with ink, or distributed with concave and convex points in either round, rectangular, diamond or polygonal form.

The present invention by providing an improved structure of a backlight module to reduce the spacing between light sources and diffuser plate, thus to reduce the thickness of the backlight module in meeting compact requirements is innovative and practical, and this application is duly filed for a utility pattern. It should be noted that the specification and drawings are provided as one of the preferred embodiments of the present invention and do not in any way limit the present invention. Therefore, any structure, device, and/or characteristics similar or equivalent to that of the present invention shall be deemed as falling within the scope of the purpose and claims made by the present invention.